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National Hospital Care Survey Demonstration Projects: Opioid-involved Emergency Department Visits, Hospitalizations, and Deaths

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Abstract

Objective—This report demonstrates the utility of linking the restricted-use 2014 National Hospital Care Survey (NHCS), 2014–2015 National Death Index (NDI), and 2014–2015 Drug-Involved Mortality (DIM) data to study opioid-involved emergency department (ED) visits, hospitalizations, and mortality within 1 year post-discharge. Example research questions and unweighted results are presented. Results are not nationally representative.

Methods—Patient records from the 2014 NHCS with sufficient identifying information were linked to the 2014–2015 NDI and DIM data. Visits were considered opioid-involved if they had *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) diagnosis codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, 970.1, or E850.0–E850.2 in any diagnosis or external cause of injury code field. Opioid-involved drug overdose deaths were deaths with an *International Classification of Diseases, 10th Revision* (ICD–10) underlying cause-of-death code of X40–44, X60–64, X85, or Y10–Y14 and a multiple cause code of T40.0–T40.4 or T40.6.

Results—In the 2014 NHCS, there were 15,495 patients with an opioid-involved ED-only visit and 24,059 patients with an opioid-involved hospitalization. Of the 20,962 patients with an opioid-involved hospitalization eligible to be linked to NDI, 1,805 died (9%) within 1 year of discharge. Of these deaths, 341 (19%) resulted from a drug overdose. Of drug overdose deaths, 243 (71%) involved an opioid, where 12% died within 30 days post-discharge, 19% within 31–90 days, and 69% within 91–365 days. Opioids most frequently mentioned included heroin (46%), fentanyl (20%), oxycodone (13%), methadone (12%), and morphine (12%). These categories are not mutually exclusive because a death may involve more than one drug. For approximately 22% of patients who died of an opioid-involved drug overdose in 2014, their last ED-only visit or hospitalization was opioid-involved.

Conclusion—While the NHCS data are not nationally representative, these unlinked and linked National Center for Health Statistics data allow for exploratory analyses of ED visits, hospitalizations, and associated mortality outcomes.

Keywords: health care • mortality • drug overdose • National Hospital Care Survey

Introduction

Decision-makers such as clinicians, policymakers, and researchers need comprehensive data on opioid-involved emergency department (ED) visits, hospitalizations, and deaths to identify and examine strategies to reduce morbidity and mortality from opioid-involved overdoses and other related harms. However, national statistics on opioid-involved hospital encounters and subsequent outcomes among the same individual patient are limited.

The National Center for Health Statistics (NCHS) received support from the Department of Health and Human Services' Office of the Secretary Patient-Centered Outcomes Research Trust Fund (PCORTF) (1) to link several data sources. The first data source, the National Hospital Care Survey (NHCS), collects ED, inpatient, and outpatient department administrative claims or electronic health records (EHR) data from a sample of participating hospitals (2). These data are not nationally representative. The second source, the National Death Index (NDI), is a centralized database of death records on file in jurisdictional vital records offices for all deaths occurring in the United States, as well as the U.S.

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military overseas (3). NCHS established NDI to aid epidemiologists and other health and medical investigators with their mortality ascertainment activities. These records are compiled annually and include detailed information on the underlying and multiple causes of death. The third source, the Drug-Involved Mortality (DIM) restricted-use data, was developed through a collaborative project between NCHS and the Food and Drug Administration (FDA) using the National Vital Statistics System (NVSS) restricted-use mortality files. This source provides information on the specific drugs involved in a death, based on information provided on the death certificate by the medical certifier—typically a medical examiner or coroner in the case of drug poisoning deaths. The DIM data may be accessed through the NCHS Research Data Center (4).

The NHCS data linked to these mortality files, while not nationally representative, have the potential to lend insights into hospital use and drug overdose deaths involving opioids. Researchers can study patients presenting to hospitals due to an opioid-involved event and examine their care either until death or the end of the study period. Conversely, researchers can also look at the population of individuals who died of an opioid-involved drug overdose in a given timeframe and examine the patterns and types of care they received before death.

This report provides examples of the types of research questions and analyses possible using the linked data on opioid-involved ED visits and hospitalizations and opioid-involved drug overdose deaths.

Methods

Data sources

These analyses use data linked across three sources: the 2014 NHCS, the 2014–2015 NDI, and the 2014–2015 DIM data. Data are restricted use and can be accessed through the Research Data Center at https://www.cdc.gov/rdc/b1datatype/dt122.htm.

NHCS

NHCS collects data from inpatient discharges and in-person visits to ED and outpatient departments, including hospital-based ambulatory surgery centers. The initial sampling frame was constructed in 2011 using the 2010 IQVIA (formerly Quintiles and IMS Government Solutions) hospital database for hospitals meeting eligibility criteria as noninstitutional, nonfederal hospitals with six or more inpatient staffed beds in the 50 states and the District of Columbia. From the sampling frame of 6,622 hospitals, a stratified list of 1,000 hospitals was created based on hospital bed size, type of hospital, and urban or rural designation and then split into two samples: a base sample of 500 hospitals and a reserve sample of 500 hospitals. The base sample was fielded for data collection, and the reserve sample was used to replenish the base sample if more hospitals were needed. In 2013, 81 hospitals with 500 or more staffed beds were moved from the reserve sample into the base sample. The 2014 sample consists of 581 hospitals: 506 acute care hospitals and 75 other specialty hospitals, including children's, psychiatric, long-term acute care, and rehabilitation hospitals. For the 2014 NHCS data collection, 94 of the 581 sampled hospitals provided inpatient department claims data and 83 hospitals provided ED claims data. Participating hospitals were asked to provide data on all ED and inpatient encounters in the 2014 calendar year. The unweighted total number of encounters was approximately 4.5 million ED visits. With a response rate of 14.3% for hospitals submitting ED data and unweighted results, the 2014 NHCS data are not nationally representative. More information on NHCS methodology is published elsewhere (5).

NDI

NDI is a centralized database of death record information on file in jurisdictional vital records or statistics offices and maintained by NCHS (3). These data can be used to identify each person who has died in the United States and U.S. military overseas and the cause(s) and manner of death. All deaths are categorized using the *International Classification of Diseases, 10th Revision* (ICD–10) for underlying and multiple causes of death (6). Drug overdose deaths are identified using underlying cause-of-death ICD–10 codes X40–X44 (unintentional), X60–X64 (intentional self-harm or suicide), X85 (homicide), and Y10–Y14 (undetermined intent). Deaths involving specific drugs or drug classes are identified using multiple cause-of-death ICD–10 codes T36–T50.8.

DIM restricted-use data

The DIM restricted-use data, also known as the National Vital Statistics System Mortality Drug Overdose (NVSS-M-DO) data, include information on the specific drugs involved in a death. The methods for preparing this file were developed collaboratively by NCHS and FDA and involve extracting information from the literal text on death certificate records obtained through the NVSS (7). The literal text is the verbatim text provided by the medical certifier—usually a medical examiner or coroner in the case of a drug overdose death—about the cause(s) and circumstances of death.

The methodology for developing the DIM data involved searching the literal text from three fields of the death certificate (the cause-of-death sequence from Part I, significant conditions contributing to death from Part II, and the "Describe how injury occurred" box) using search terms for specific drugs. Search terms included generic drug names, brand names, common usage or street names, abbreviations, metabolites, misspellings, and other variations. Each search term was mapped to a "principal variant," the overarching label assigned to a drug, a drug class, or exposure not otherwise specified (7).

Data linkage processes

A description of the linkage of the 2014 NHCS to the 2014–2015 NDI has been published elsewhere (8). To link to the DIM restricted-use data, which includes the specific drugs mentioned in the literal text of death certificate records (i.e., Part I, Part II, and Describe how injury occurred), only those NHCS

patient records that were eligible for and successfully linked to the 2014–2015 NDI could be linked to the 2014–2015 DIM files. NHCS records that were already linked to the 2014–2015 NDI were linked to the 2014–2015 DIM files using a unique ID consisting of the year of death, jurisdiction of death, and death certificate number.

Analysis

Opioid-involved ED visits and hospitalizations were identified by applying an algorithm previously developed utilizing NHCS data, but with minor modifications (9). NHCS records were flagged as opioid-involved if they had any mention of the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, 970.1, or E850.0–E850.2 in any diagnosis or external cause code field. These include codes for past or present opioid (including opium, heroin, methadone, and other opiates and related narcotics) use, abuse, dependence, and poisoning; narcotics affecting the fetus or newborn; and poisoning by opiate antagonists (e.g., naloxone). Codes for opioids causing adverse effects in therapeutic use (E935.0–E935.2, E940.1) were not included.

Newborns (identified using ICD–9–CM diagnosis codes V30–V39) and those who died during hospitalization were excluded from analyses. ED visits that resulted in the patient being admitted to the hospital were excluded from analyses of ED-only visits but were included in analyses of hospitalizations. Numbers and percentages were calculated to illustrate several types of research questions that can be explored with these data. Due to the low response rate of NHCS, the results presented in this report are not nationally representative.

Drug overdose deaths were identified using the ICD–10 underlying cause-of-death codes X40–X44 (unintentional), X60–X64 (intentional self-harm or suicide), X85 (homicide), and Y10–Y14 (undetermined intent). Drug overdose deaths involving an opioid were identified using ICD–10 underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14 in combination with at least one multiple cause-of-death code T40.0–T40.4 or T40.6 (includes opium, heroin, other natural and semisynthetic opioids, methadone, other synthetic opioids, and unspecified narcotics). Deaths that were not due to a drug overdose had an underlying cause code other than X40–X44, X60–X64, X85, or Y10–Y14. The most frequent underlying causes of death other than drug overdose were grouped by ICD–10 chapter (6). ICD–10 chapters that occurred for less than 4% of deaths were combined into the category, "All other ICD–10 chapters."

Analyses examining the time from the date of hospital discharge to when the death occurred were arranged into three time interval categories: 1) death occurring within 30 days post-discharge, 2) deaths occurring within 31 and 90 days post-discharge, and 3) deaths occurring within 91 and 365 days post-discharge.

Urbanization levels, based on hospital location from NHCS, are delineated in accordance with the 2010 Office of Management and Budget standards for defining metropolitan statistical areas (MSA), which are areas containing a large population nucleus together with adjacent communities having a high degree of economic and societal integration, as determined by the U.S. Census Bureau (10). The "urban" and "suburban" categories are large central metro and fringe metro counties, respectively, of an MSA with a population of 1 million or more. "Small metro" consists of MSAs with less than 1 million population and "rural" consists of areas that are nonmetropolitan.

The four regions, based on hospital location from NHCS, are based on the U.S. Census Bureau's definitions: "West" includes the Pacific and Mountain states (i.e., Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming); "South" includes the south-central and southeastern parts of the country (i.e., Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia); "Midwest" includes the north-central area of the country (i.e., Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin); and the "Northeast" includes the mid-Atlantic and New England areas (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) (11).

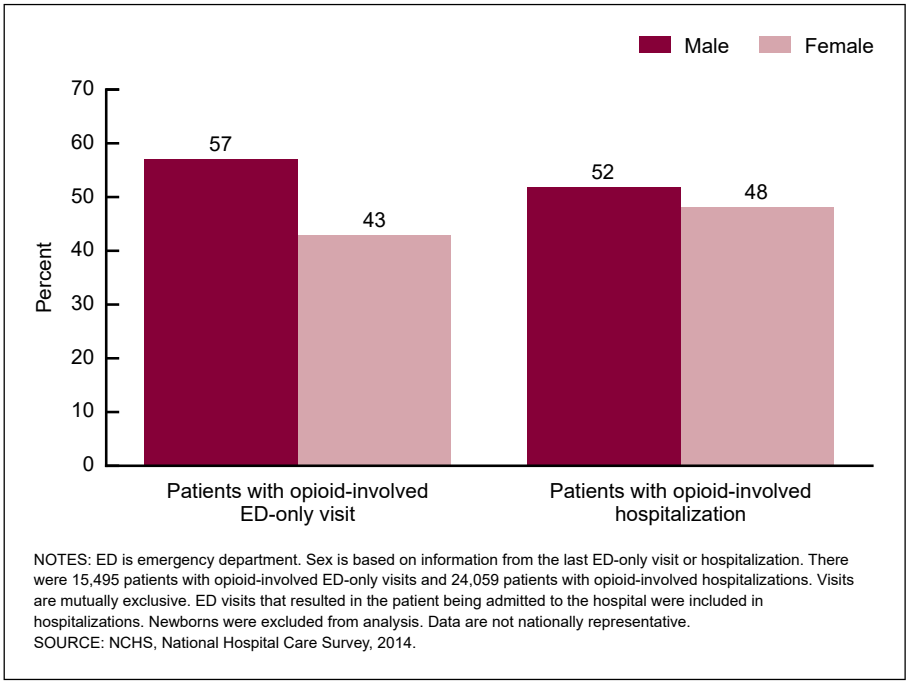
Examples of research questions

There are several types of research approaches that can be taken with these data. NHCS data can be used alone (unlinked) to examine characteristics of patients and visits within a certain year. As described previously, NHCS data can also be linked with NDI and other data sources, such as the DIM files, to conduct cohort-type analyses where patients are identified from ED visits or hospitalizations and then followed to assess mortality outcomes, or characterized by cause of death and analyzed to examine patterns in hospital care prior to death. Example research questions and results are presented for these various approaches. Please see Appendices I–V for visualizations of the respective populations of interest for each of the various types of research questions and results.

Example analyses of the 2014 NHCS

Patient-level: What are the age, sex, and expected source of payment distributions for patients who had an opioid-involved ED-only visit or hospitalization in the 2014 NHCS?

In the 2014 NHCS, there were 15,495 patients who had an opioid-involved ED-only visit and 24,059 patients who had an opioid-involved hospitalization (Figure 1). Visits are mutually exclusive with patients who were admitted to the hospital through the ED being counted only in the hospitalization group. Among patients with an opioid-involved ED-only visit, about 57% were male and 43% were



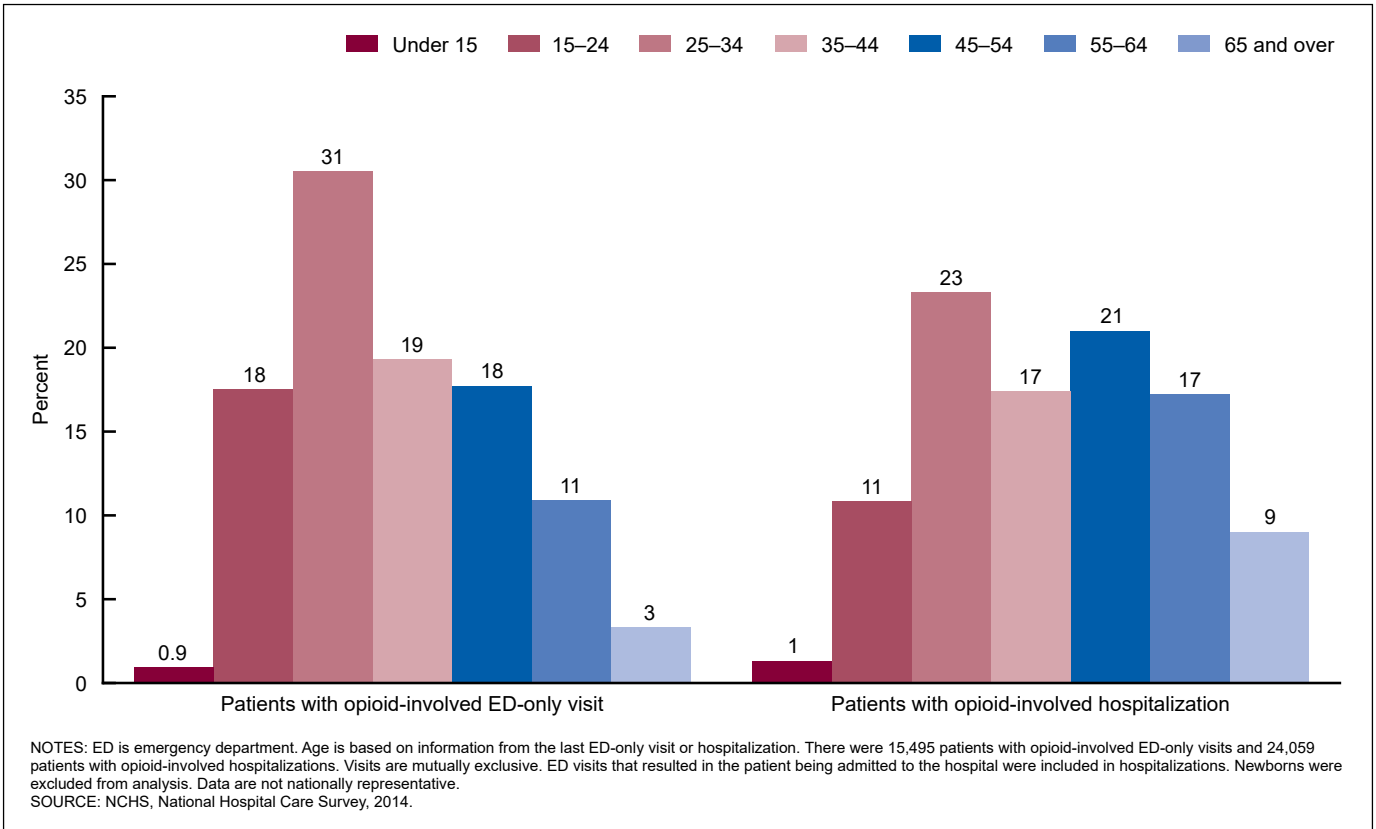
NOTES: ED is emergency department. Sex is based on information from the last ED-only visit or hospitalization. There were 15,495 patients with opioid-involved ED-only visits and 24,059 patients with opioid-involved hospitalizations. Visits are mutually exclusive. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns were excluded from analysis. Data are not nationally representative.
SOURCE: NCHS, National Hospital Care Survey, 2014.

Figure 1. Sex distribution among patients with an opioid-involved emergency department-only visit or hospitalization: National Hospital Care Survey, 2014

female. Among patients with an opioid-involved hospitalization, 52% were male and 48% were female. For further detail see Appendix I.

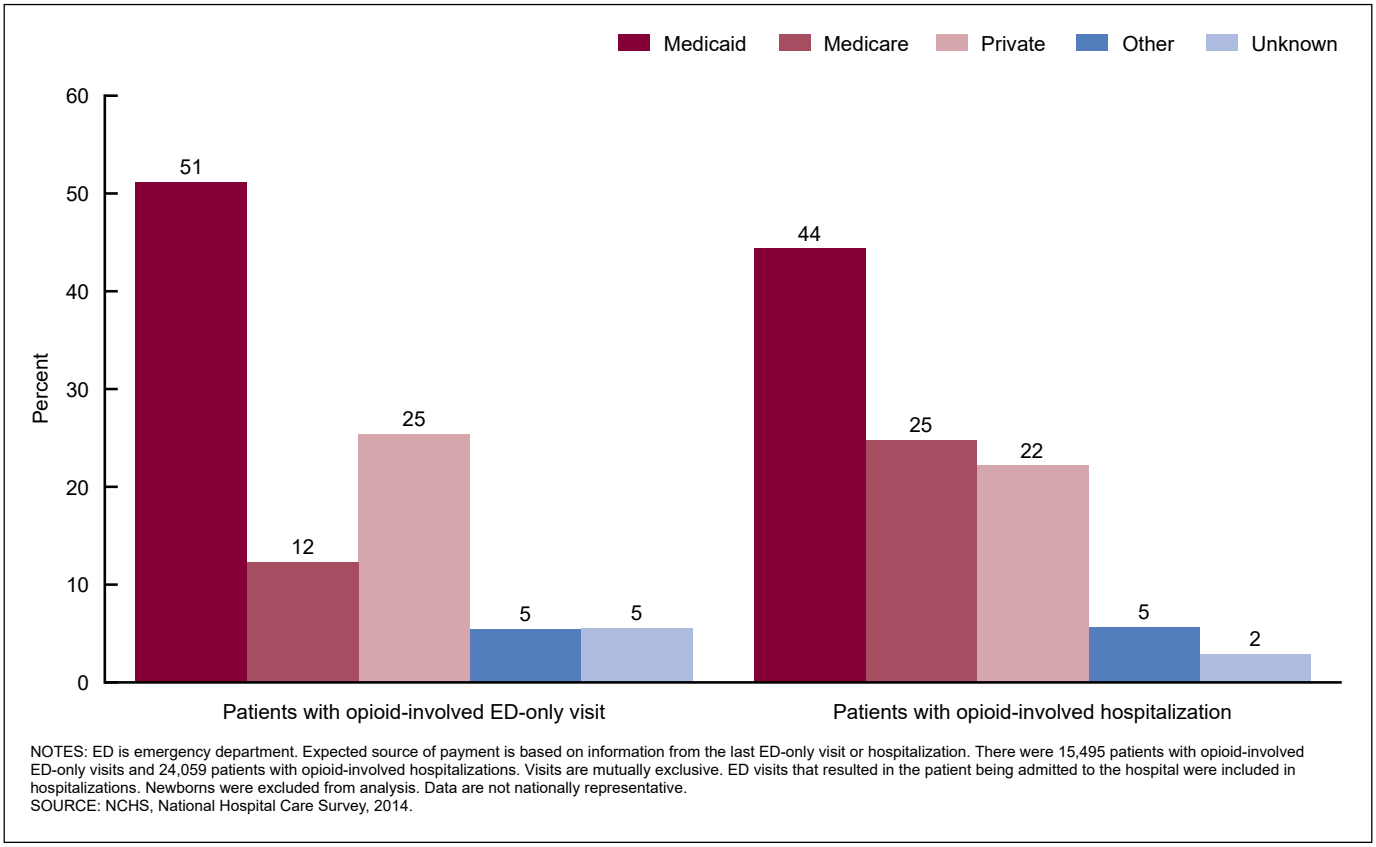
About 18% of patients with an opioid-involved ED-only visit were aged 15–24 years, 31% were 25–34, 19% were 35–44, 18% were 45–54, and 14% were 55 and over (Figure 2 and Appendix I). For patients with an opioid-involved hospitalization, about 11% were aged 15–24 years, 23% were 25–34, 17% were 35–44, 21% were 45–54, and 26% were 55 and over.

For patients with an opioid-involved ED-only visit, the expected source of payment for their last opioid-involved ED-only visit was approximately 51% Medicaid, 12% Medicare, and 25% private insurance (Figure 3). For patients with an opioid-involved hospitalization, the expected source of payment for their last opioid-involved hospitalization was



NOTES: ED is emergency department. Age is based on information from the last ED-only visit or hospitalization. There were 15,495 patients with opioid-involved ED-only visits and 24,059 patients with opioid-involved hospitalizations. Visits are mutually exclusive. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns were excluded from analysis. Data are not nationally representative.
SOURCE: NCHS, National Hospital Care Survey, 2014.

Figure 2. Age distribution among patients with an opioid-involved emergency department-only visit or hospitalization: National Hospital Care Survey, 2014



NOTES: ED is emergency department. Expected source of payment is based on information from the last ED-only visit or hospitalization. There were 15,495 patients with opioid-involved ED-only visits and 24,059 patients with opioid-involved hospitalizations. Visits are mutually exclusive. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns were excluded from analysis. Data are not nationally representative.
SOURCE: NCHS, National Hospital Care Survey, 2014.

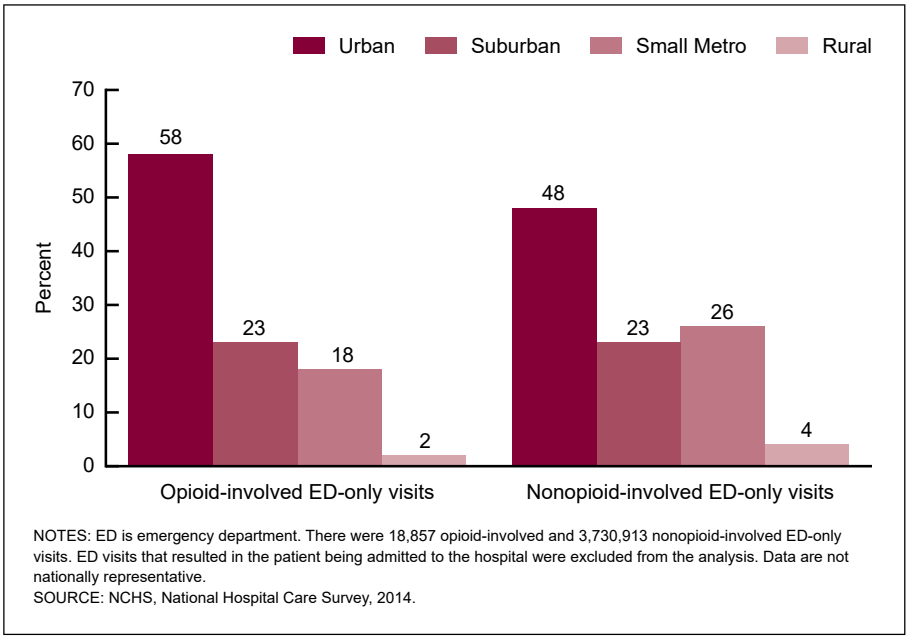
Figure 3. Distribution of expected source of payment among patients with an opioid-involved emergency department-only visit or hospitalization: National Hospital Care Survey, 2014

approximately 44% Medicaid, 25% Medicare, and 22% private insurance. For additional detail see Appendix I.

Visit-level: What are the geographic distributions for opioid-involved and nonopioid-involved ED-only visits?

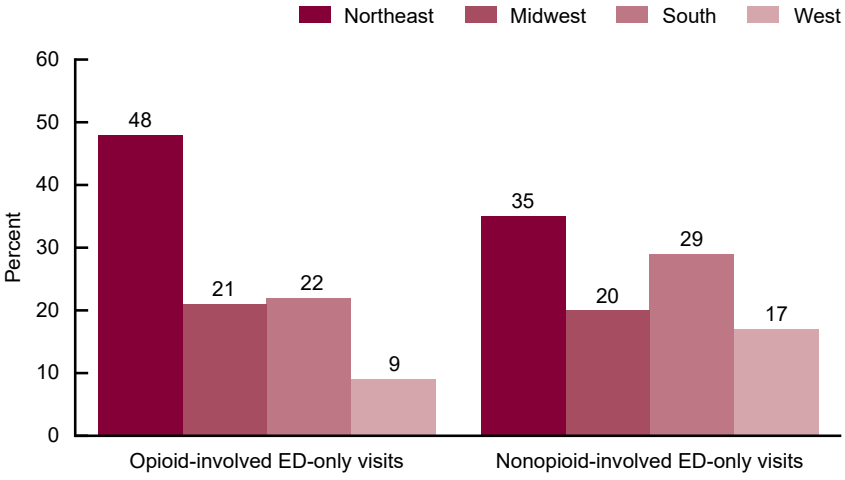
Visit-level analyses are presented to demonstrate the geographical burden of opioid-involved ED-only visits. There were 18,857 ED-only visits that were opioid-involved and 3,730,913 ED-only visits that were not opioid-involved (see Appendix I). Of the opioid-involved ED-only visits in 2014, 58% occurred in urban areas, 23% in suburban areas, 18% in small metropolitan areas, and 2% in rural areas. Among the ED-only visits that were not opioid-involved, 48% occurred in urban areas, 23% in suburban areas, 26% in small metropolitan areas, and 4% in rural areas (Figure 4).

Among the opioid-involved ED-only visits occurring in the 2014 NHCS, 48% occurred in the Northeast, 21% in the Midwest, 22% in the South, and 9% in the West (Figure 5 and Appendix I). Among the ED-only visits that were not opioid-involved, 35% occurred in the Northeast, 20% in the Midwest, 29% in the South, and 17% in the West.



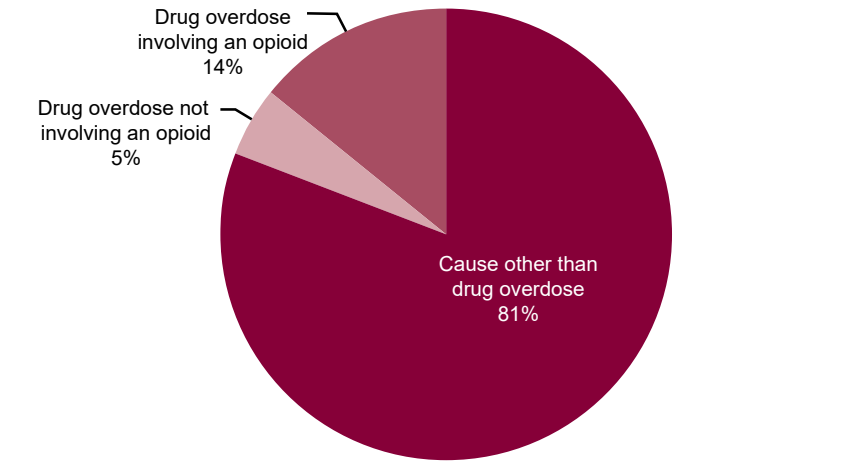
NOTES: ED is emergency department. There were 18,857 opioid-involved and 3,730,913 nonopioid-involved ED-only visits. ED visits that resulted in the patient being admitted to the hospital were excluded from the analysis. Data are not nationally representative.
SOURCE: NCHS, National Hospital Care Survey, 2014.

Figure 4. Urban or rural classification for opioid-involved and nonopioid-involved emergency department-only visits: National Hospital Care Survey, 2014



NOTES: ED is emergency department. There were 18,857 opioid-involved and 3,730,913 nonopioid-involved ED-only visits. ED visits that resulted in the patient being admitted to the hospital were excluded from the analysis. Data are not nationally representative.
SOURCE: NCHS, National Hospital Care Survey, 2014.

Figure 5. Census regions for opioid-involved and nonopioid-involved emergency department-only visits: National Hospital Care Survey, 2014



NOTES: Patients with an opioid-involved hospitalization who died within 1 year post-discharge is based on information from the last opioid-involved hospitalization. This 1,803 represents the number of linkage-eligible patients with an opioid-involved hospitalization who died within 1 year post-discharge and had an underlying cause of death. Emergency department visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records that did not have an underlying cause of death were also excluded from analysis. Data are not nationally representative.
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Figure 6. Percentages of patients with an opioid-involved hospitalization who died within 1 year post-discharge due to a drug overdose involving an opioid, a drug overdose not involving an opioid, or some other cause: National Hospital Care Survey, 2014, linked to National Death Index, 2014 and 2015

Example analyses of the 2014 NHCS linked to the 2014–2015 NDI and the 2014–2015 DIM data

How many patients with an opioid-involved hospitalization died within 1 year post-discharge?

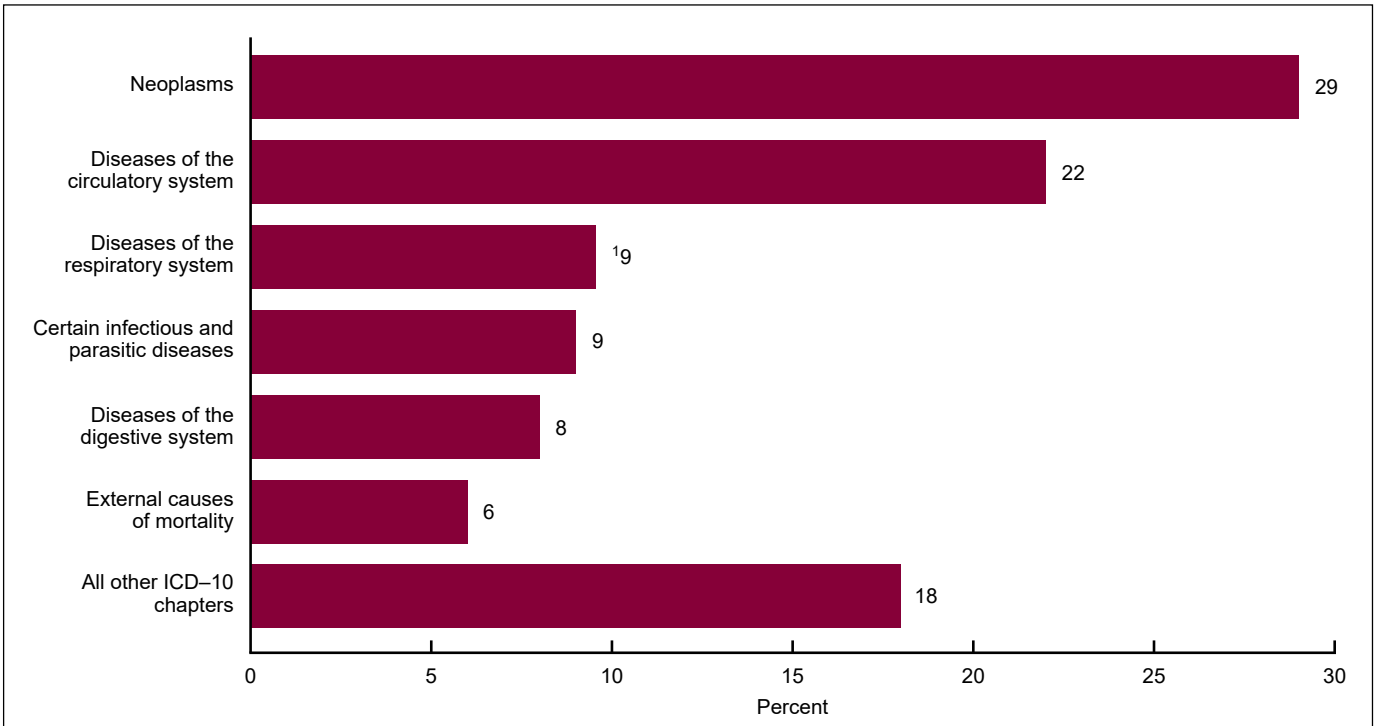
Of the 24,059 patients with an opioid-involved hospitalization, 20,962 (87%) were eligible for linkage to NDI and alive at discharge. Among these 20,962 patients, 1,805 (9%) had a date of death and 19,157 (91%) were presumed alive within 1 year post-discharge. Two records had a date of death but did not have an underlying cause of death. Of the remaining 1,803 patients who died, 341 (19%) died from a drug overdose and 1,462 (81%) died from a cause other than drug overdose (Figure 6). Of the 341 patients who died of a drug overdose, 243 (71%) of the deaths involved an opioid (see also Appendix II).

For patients who died of a cause other than drug overdose, what were the causes?

Of the 1,462 patients who had at least one opioid-involved hospitalization and died of a cause other than drug overdose within 1 year post-discharge, 29% of the deaths were due to neoplasms (cancer), 22% were due to diseases of the circulatory system, 9% were due to diseases of the respiratory system, and 9% were due to infectious or parasitic diseases (Figure 7 and Appendix II).

What are the most common time intervals from date of discharge to date of death for patients who had an opioid-involved hospitalization and died within 1 year post-discharge?

Of the 1,462 patients with an opioid-involved hospitalization who died within 1 year post-discharge due to a cause other than drug overdose, 22% died within 30 days post-discharge, 22% within 31–90 days, and 55% within 91–365 days. Of the 98 patients with an opioid-involved hospitalization who died within 1 year post-discharge due to a drug overdose not involving an opioid, 25% died within 30



[1]Bar length may not appear equal due to rounding.
NOTES: ICD–10 is *International Classification of Diseases, 10th Revision*. Patients with an opioid-involved hospitalization who died within 1 year post-discharge is based on information from the last opioid-involved hospitalization. The denominator (n = 1,462) is the number of patients who died within 1 year post-discharge of a cause other than drug overdose. Emergency department visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Figures may not add to 100 because of rounding. Data are not nationally representative.
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Figure 7. Most frequent underlying causes of death by ICD–10 chapter for patients with an opioid-involved hospitalization who died within 1 year post-discharge due to a cause other than drug overdose: National Hospital Care Survey, 2014, linked to National Death Index, 2014 and 2015

days post-discharge, 16% within 31–90 days, and 59% within 91–365 days. Of the 243 patients with an opioid-involved hospitalization who died within 1 year post-discharge due to a drug overdose involving an opioid, 12% died within 30 days post-discharge, 19% within 31–90 days, and 69% within 91–365 days (Table A and Appendix II).

For patients with an opioid-involved hospitalization who died within 1 year post-discharge of a drug overdose involving an opioid, what were the specific opioids identified on the death certificate?

Of the 243 patients with an opioid-involved hospitalization who died within 1 year post-discharge of a drug overdose involving an opioid, 46% involved heroin, 20% involved fentanyl, 13% involved oxycodone, 12% involved methadone, and 12% involved morphine. Deaths may involve more than one drug (Table B and Appendix II).

For patients who died of a drug overdose in 2014, what were their patterns of hospital care use in the 2014 NHCS?

Among the 1,014 patients with ED-only visits who died of a drug overdose in 2014, 83% did not have an opioid-involved ED-only visit, 13% had one opioid-involved ED-only visit, and 4% had more than one opioid-involved ED-only visit in 2014. Among those who died of another cause or were presumed alive, more than 99% did not have an opioid-involved ED-only visit (Table C and Appendix III).

Similarly, among the 568 patients with hospitalizations who died of a drug overdose in 2014, 70% had no opioid-involved hospitalizations, 25% had one opioid-involved hospitalization, and

Table A. Time interval from date of discharge for last opioid-involved hospitalization to date of death, by cause of death

Time interval (post-discharge)	Death due to cause other than drug overdose		Death due to drug overdose not involving an opioid		Death due to drug overdose involving an opioid	
	Number	Percent	Number	Percent	Number	Percent
Within 30 days	326	22.3	24	24.5	28	11.5
Within 31–90 days	327	22.4	16	16.3	47	19.3
Within 91–365 days	809	55.3	58	59.2	168	69.1
Total	1,462	100.0	98	100.0	243	100.0

NOTES: Emergency department visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Data are not nationally representative.
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

6% had more than one opioid-involved hospitalization in 2014. Among those who died of another cause or were presumed alive, around 98% did not have an opioid-involved hospitalization (Table D and Appendix IV).

For patients who died of a drug overdose involving an opioid in 2014 and had at least one ED-only visit or hospitalization, was the last 2014 NHCS visit prior to death opioid-involved?

Patients who died of a drug overdose involving an opioid in 2014 and had at least one ED-only visit or hospitalization in 2014 were examined. Of the 698 patients who died of a drug overdose involving an opioid in 2014 and who had at least one ED-only visit or hospitalization in 2014, the last ED-only visit or hospitalization prior to death was opioid-involved for 22% of those decedents (Table E and Appendix V).

For the patients who died of a drug overdose involving an opioid in 2014 and whose last 2014 NHCS ED-only visit or hospitalization was not opioid-involved, what were the most frequent principal diagnoses?

For the 545 patients who died of a drug overdose involving an opioid in 2014 and whose last ED-only visit or hospitalization in 2014 was not opioid-involved, the distribution of principal diagnoses for the last ED-only visit or hospitalization was ill-defined conditions (19%), injury and poisoning (17%), mental disorders (15%), and other conditions (49%) (Table F and Appendix V).

Table B. Specific opioids identified on death certificates among patients with an opioid-involved hospitalization who died within 1 year post-discharge of a drug overdose involving an opioid

Drug	Number[1]	Percent
Heroin	111	45.7
Fentanyl	48	19.7
Oxycodone	31	12.8
Methadone	29	11.9
Morphine	28	11.5
Hydrocodone	10	4.1
Other opioids[2]	21	8.6
The term “opioid” or “opiate” was noted, but no specific drug was named	23	9.5

[1]Categories are not mutually exclusive. A death may involve more than one opioid (e.g., a death involving both hydrocodone and heroin would be counted in both categories). Deaths may also involve drugs other than opioids.
[2]Includes oxymorphone, codeine, hydromorphone, buprenorphine, and tramadol. For each of these drugs, there were fewer than 10 deaths that mentioned this drug as involved in the death.

NOTES: Emergency department visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Data are not nationally representative. There were 243 decedents with an opioid mentioned as involved in the death.

SOURCES: NCHS, 2014 National Hospital Care Survey linked to the 2014–2015 National Death Index and to the 2014–2015 Drug-Involved Mortality.

Table C. Number and percentage of patients by number of opioid-involved ED-only visits and mortality outcome in 2014

Characteristic	Died of a drug overdose		Died of another cause		Presumed alive	
	Number	Percent	Number	Percent[1]	Number	Percent
No opioid-involved ED-only visits	845	83.3	31,799	99.4	2,352,763	99.4
One opioid-involved ED-only visit	133	13.1	178	0.6	12,185	0.5
More than one opioid-involved ED-only visit	36	3.6	26	0.1	2,007	0.1
Total	1,014	100.0	32,003	100.0	2,366,955	100.0

[1]Figures may not add to 100.0 because of rounding.

NOTES: ED is emergency department. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Two records that did not have an underlying cause of death were excluded from analysis. Data are not nationally representative.

SOURCE: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Table D. Number and percentage of patients by number of opioid-involved hospitalizations and mortality outcome in 2014

Characteristic	Died of a drug overdose		Died of another cause		Presumed alive	
	Number	Percent	Number	Percent	Number	Percent
No opioid-involved hospitalizations	395	69.5	60,844	98.6	905,170	97.9
One opioid-involved hospitalization	139	24.5	675	1.1	16,507	1.8
More than one opioid-involved hospitalization	34	6.0	198	0.3	3,149	0.3
Total	568	100.0	61,717	100.0	924,826	100.0

NOTES: Emergency department visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Data are not nationally representative.

SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Table E. Number and percentage of patients who died of a drug overdose involving an opioid in 2014 and who had at least one ED-only visit or hospitalization in 2014

Characteristic	Number	Percent
Died of a drug overdose involving an opioid in 2014 and had at least one ED-only visit or hospitalization in 2014	698	100.0
Last ED-only visit or hospitalization was opioid-involved	153	21.9
Last ED-only visit or hospitalization was not opioid-involved	545	78.1

NOTES: ED is emergency department. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Data are not nationally representative.

SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Table F. Principal diagnoses for patients who died of a drug overdose involving an opioid in 2014 and whose last 2014 NHCS ED-only visit or hospitalization was not opioid-involved

ICD–9–CM chapter	Number	Percent
Ill-defined conditions	102	18.7
Injury and poisoning	92	16.9
Mental disorders	81	14.9
Musculoskeletal system diseases	47	8.6
Respiratory system diseases	39	7.2
Circulatory system diseases	30	5.5
Contact with health services	28	5.1
Nervous system diseases	26	4.8
Skin diseases	24	4.4
Digestive system diseases	24	4.4
Other ICD–9–CM chapters[1]	52	9.5
Total	545	100.0

[1]Includes *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) chapters: Infectious and parasitic diseases, Genitourinary system diseases, Endocrine diseases, Blood diseases, Complications of pregnancy, Neoplasms, and Congenital anomalies.

NOTES: ED is emergency department. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Data are not nationally representative.

SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Discussion

The findings of these analyses demonstrate the breadth of topics that can be investigated using linked hospital care and mortality data. Researchers can examine patients' hospital care; 30-, 90-, and 365-day post-hospital discharge mortality; and cause of death for those who died. For instance, in the example focusing on the 341 patients who had an opioid-involved hospitalization and also died due to a drug overdose within 1 year post-discharge, this study found that 71% (243) of the deaths involved an opioid, where 12% died within 30 days post-discharge, 19% within 31–90 days, and 69% within 91–365 days. Furthermore, linkage to the DIM data enables researchers to identify the specific drugs involved in deaths among patients. For those who died of an opioid-involved drug overdose within 1 year post-discharge of an opioid-involved hospitalization in the 2014 NHCS, the most commonly involved opioids included heroin, fentanyl, oxycodone, methadone, and morphine. Additionally, researchers can examine patterns of hospital care among patients who died, such as the number of opioid-involved ED-only visits or hospitalizations prior to death. For instance, in the example analyzing patients with hospitalizations by mortality outcomes in 2014, this study found that about 70% of those who died of a drug overdose and over 98% of those who died of another cause had no opioid-involved hospitalizations; 6% of those who died of a drug overdose and 0.3% of those who died of another cause had more than one opioid-involved hospitalization in 2014. While these data are not nationally representative, these examples highlight the novel information available and the potential for analyses of hospitalizations and ED visits related to opioids and subsequent mortality outcomes among patients with opioid-related hospital encounters, which other data sources cannot provide.

Interpretation of any results of this study should take into consideration the limitations of the data and methodologies. NHCS is not currently nationally representative. The results of these analyses are not generalizable because they are only based on the hospitals participating in the 2014 NHCS and do not capture events that may happen at other non-NHCS facilities. The estimates reported are unweighted and, therefore, these estimates are not nationally representative. NCHS has been making efforts to increase hospital participation so that national estimates can be made in the future.

The linked data only include hospitals participating in 2014, so any hospital care received outside of 2014 is not included in the analyses. For the examples presented that select patients based on mortality outcomes (e.g., drug overdose deaths) and examine any prior hospital care visits, it is important to note that both encounters and deaths were limited to events occurring solely in 2014. Also, another limitation is that the length of time between hospital visits and death can vary. For instance, if a patient died of a drug overdose in February 2014, only hospital visits in the sample occurring in January and February 2014 could be analyzed for this patient, whereas if a patient died of a drug overdose in December 2014, a longer period of time (i.e., January to December) would be available to capture any potential hospital visits. Interpretation of the results should consider these limitations of the data. Future NHCS releases could be used to evaluate longer periods of follow-up.

The case definition for opioid-involved ED-only visits and hospitalizations consists of ICD–9–CM codes for past or present opioid (including opium, heroin, methadone, and other opiates and related narcotics) use, abuse, dependence, and poisoning; narcotics affecting the fetus or newborn; and poisoning by opiate antagonists. Therefore, cases included in these analyses are not limited only to patients who reported to the hospital because of an opioid overdose but can include patients presenting to the hospital for other reasons if codes indicate a history of opioid dependence or abuse. For example, a record may be

assigned a code for opioid dependence or abuse, yet the primary reason for the patient visiting the hospital may be for another health problem or condition, such as cancer treatment. Interpretations of the findings in this report should consider the composition of this study population.

Providers may differ in their practices for diagnosing (and thus the ICD–9–CM coding of) opioid and other drug-involved ED visits and hospitalizations. Also, a hospital facility's capacity to conduct toxicological testing on suspected drug poisonings can vary, which can lead to inconsistent reporting of opioid involvement across hospitals in the United States. Interpretation of the findings should consider these potential biases and misclassifications. In addition, the reporting of specific drugs on death certificates may vary by death investigation and reporting practices in the United States. The medical certifier, typically a medical examiner or coroner in cases of sudden and unexpected deaths (e.g., drug overdoses), relies on his or her capacity to test and collect information necessary for determining the causes and manner of the death. The infrastructure, resources, and expertise available for conducting and interpreting autopsies and toxicological tests, as well as the reporting tendencies of the medical certifier, can affect the specific drugs reported on death certificates. The information on the drugs involved in a death are limited to those written by the medical certifier on the death certificate. NCHS has made significant efforts to improve cause-of-death reporting, particularly in the case of drug overdoses, and the specificity of drugs reported on death certificates has increased substantially over the past few years (12).

Even considering these limitations, this report demonstrates the utility of the newly linked data set consisting of the 2014 NHCS, the 2014–2015 NDI, and the 2014–2015 DIM data. The linked data, while not yet nationally representative, can lend insights into hospital use and drug overdose deaths involving opioids. This information can be used to inform care for patients with opioid use disorders and drug overdose prevention efforts.

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Table 1. Characteristics of patients with an opioid-involved ED-only visit or hospitalization, 2014

Characteristic[1]	ED-only visit		Hospitalization	
	Number	Percent[2]	Number	Percent
Overall	15,495	100.0	24,059	100.0
Sex				
Male	8,855	57.1	12,477	51.9
Female	6,640	42.9	11,582	48.1
Age group (years)				
0–14	140	0.9	308	1.3
15–24	2,704	17.5	2,589	10.8
25–34	4,725	30.5	5,613	23.3
35–44	2,984	19.3	4,176	17.4
45–54	2,740	17.7	5,045	21.0
55–64	1,688	10.9	4,150	17.2
65 and over	514	3.3	2,178	9.0
Expected source of payment				
Medicaid	7,939	51.2	10,682	44.4
Medicare	1,899	12.3	5,963	24.8
Private	3,936	25.4	5,349	22.2
Other	856	5.5	1,372	5.7
Unknown	865	5.6	693	2.9

[1]Based on information from the last ED-only visit or hospitalization.
[2]Figures may not add to 100.0 because of rounding.

NOTES: ED is emergency department. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns were excluded from analysis. Data are not nationally representative.

SOURCE: NCHS, National Hospital Care Survey, 2014.

Table 2. Characteristics of hospitals for ED-only visits, 2014

Characteristic[1]	ED-only visits that were opioid-involved		ED-only visits that were not opioid-involved	
	Number	Percent	Number	Percent
Overall	18,857	100.0	3,730,913	100.0
Urban or rural				
Urban	10,942	58.0	1,778,173	47.7
Suburban	4,288	22.7	863,205	23.1
Small metro	3,296	17.5	957,308	25.7
Rural	331	1.8	132,227	3.5
Census region				
Northeast	9,054	48.0	1,310,627	35.1
Midwest	4,002	21.2	741,291	19.9
South	4,206	22.3	1,064,773	28.5
West	1,595	8.5	614,222	16.5

[1]Based on information from the last ED-only visit.

NOTES: ED is emergency department. ED visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Data are not nationally representative.

SOURCE: NCHS, National Hospital Care Survey, 2014.

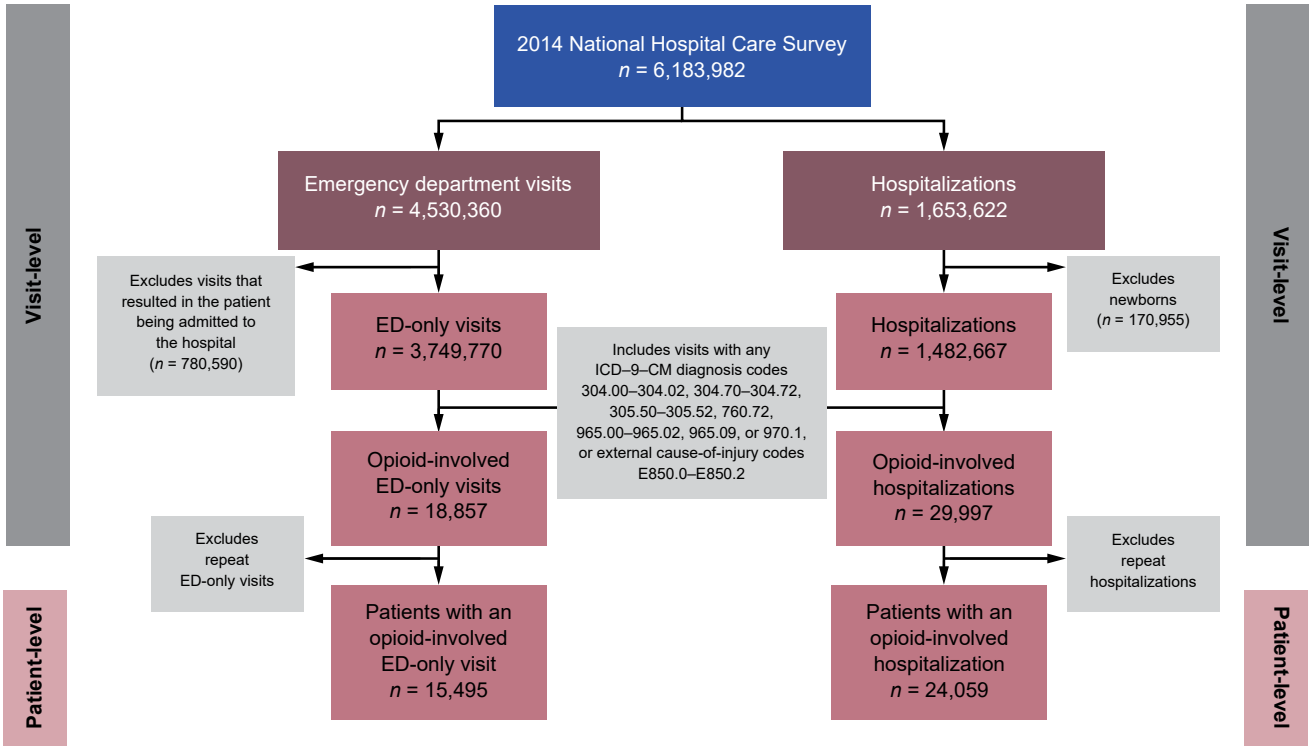
Table 3. Most frequent underlying causes of death for patients with an opioid-involved hospitalization who died within 1 year post-discharge of a cause other than drug overdose

Cause of death (ICD–10 chapter)	Number	Percent
Neoplasms	423	28.9
Diseases of the circulatory system	316	21.6
Diseases of the respiratory system	136	9.3
Certain infectious and parasitic diseases	128	8.8
Diseases of the digestive system	110	7.5
External causes of mortality	90	6.2
All other ICD–10 chapters	259	17.7
Total	1,462	100.0

NOTES: ICD–10 is *International Classification of Diseases, 10th Revision*. One year post-discharge is based on the last opioid-involved hospitalization. Emergency department visits that resulted in the patient being admitted to the hospital were included in hospitalizations. Newborns and those who died during the hospitalization were excluded from analysis. Two records did not have an underlying cause of death and were also excluded from analysis. Data are not nationally representative.

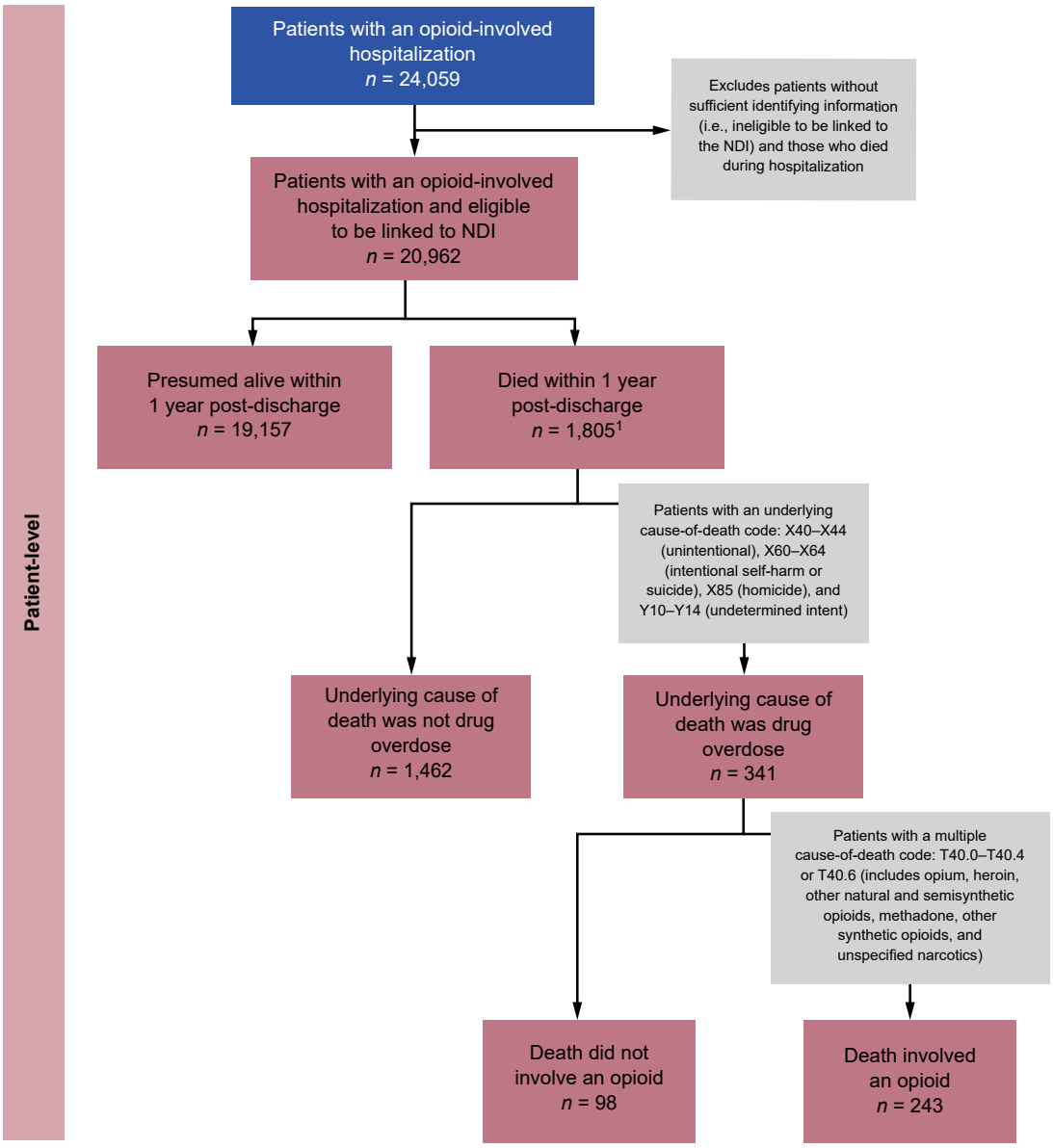
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Appendix I. Figure. Study Population for Analyses of the 2014 National Hospital Care Survey: Figures 1–5 and Tables 1 and 2.



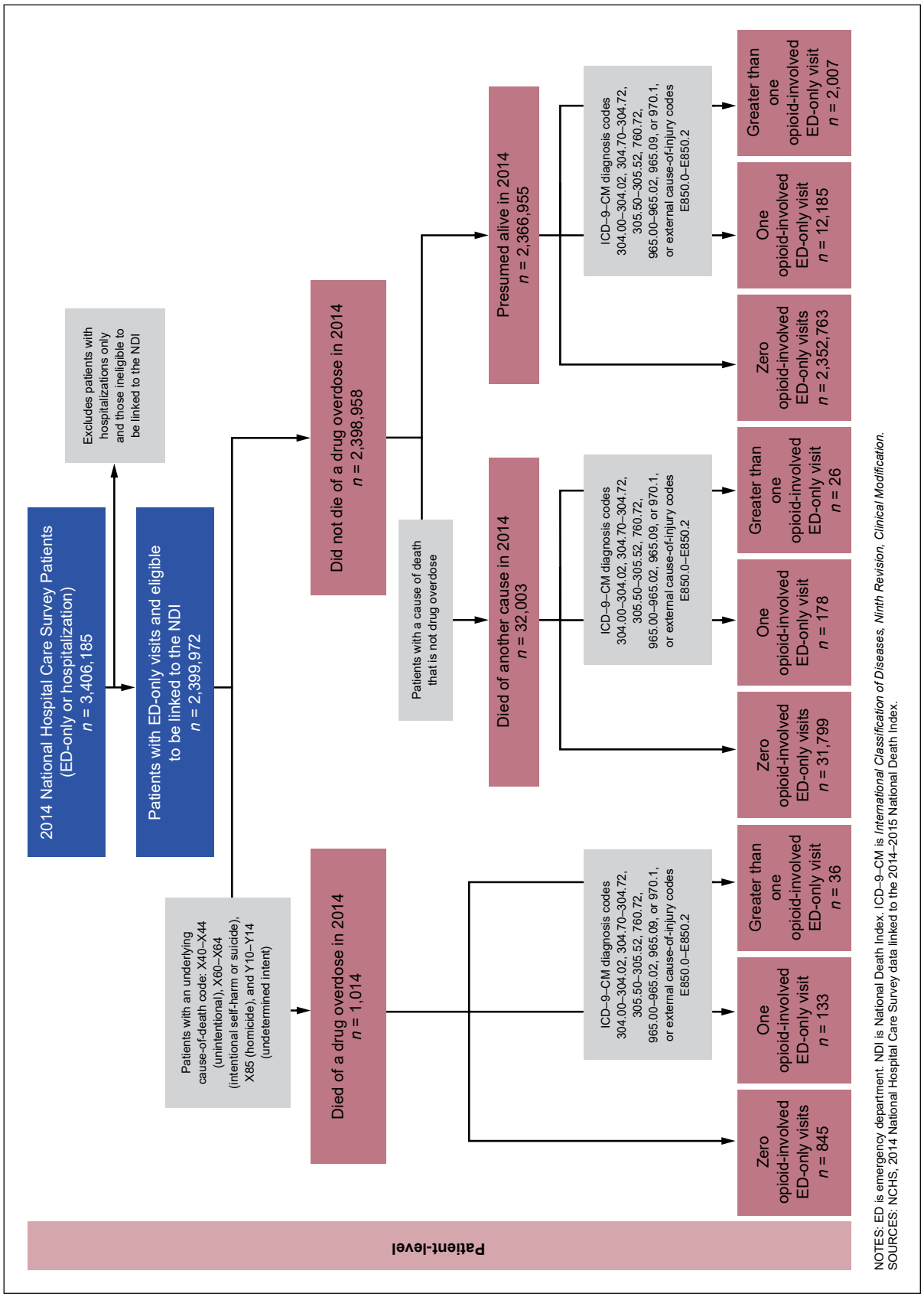
NOTES: ED is emergency department. ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*.
SOURCE: NCHS, National Hospital Care Survey, 2014.

Appendix II. Figure. Study Population for Analyses of the 2014 National Hospital Care Survey Linked to the 2014–2015 National Death Index and the 2014–2015 Drug-Involved Mortality Data: Figures 6 and 7, Tables A and B, and Table 3


Patient-level
Patients with an opioid-involved hospitalization
n = 24,059
Excludes patients without sufficient identifying information (i.e., ineligible to be linked to the NDI) and those who died during hospitalization
Patients with an opioid-involved hospitalization and eligible to be linked to NDI
n = 20,962
Presumed alive within 1 year post-discharge
n = 19,157
Died within 1 year post-discharge
n = 1,805[1]
Patients with an underlying cause-of-death code: X40–X44 (unintentional), X60–X64 (intentional self-harm or suicide), X85 (homicide), and Y10–Y14 (undetermined intent)
Underlying cause of death was not drug overdose
n = 1,462
Underlying cause of death was drug overdose
n = 341
Patients with a multiple cause-of-death code: T40.0–T40.4 or T40.6 (includes opium, heroin, other natural and semisynthetic opioids, methadone, other synthetic opioids, and unspecified narcotics)
Death did not involve an opioid
n = 98
Death involved an opioid
n = 243

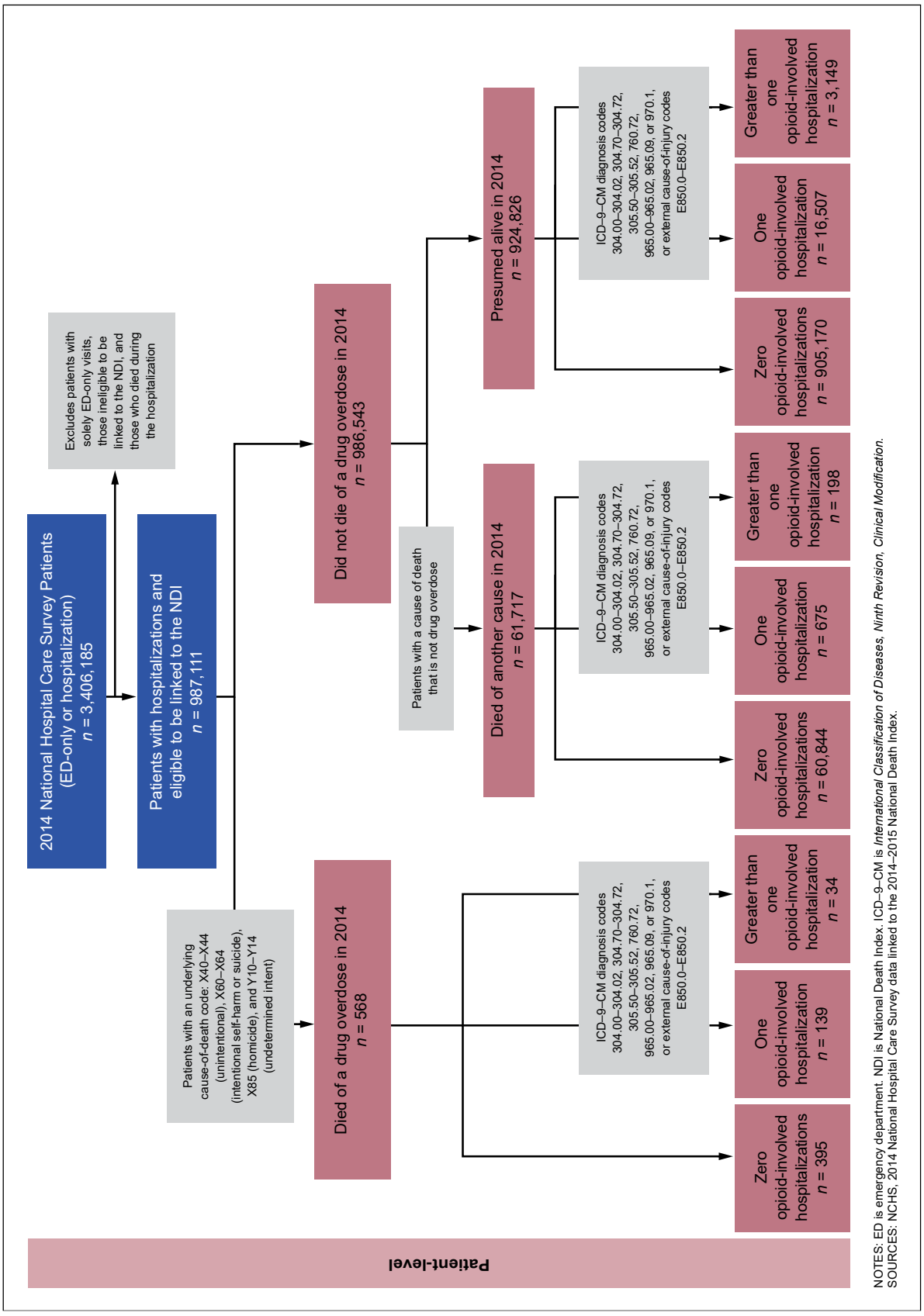
[1]Two patients did not have an underlying cause of death and were not included in the counts below.
NOTE: NDI is National Death Index.
SOURCE: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Appendix III. Figure. Study Population for Analyses of the 2014 National Hospital Care Survey Linked to the 2014–2015 National Death Index: Table C


2014 National Hospital Care Survey Patients (ED-only or hospitalization) n = 3,406,185
Excludes patients with hospitalizations only and those ineligible to be linked to the NDI
Patients with ED-only visits and eligible to be linked to the NDI n = 2,399,972
Patients with an underlying cause-of-death code: X40–X44 (unintentional), X60–X64 (intentional self-harm or suicide), X85 (homicide), and Y10–Y14 (undetermined intent)
Died of a drug overdose in 2014 n = 1,014
ICD–9–CM diagnosis codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, or 970.1, or external cause-of-injury codes E850.0–E850.2
Greater than one opioid-involved ED-only visit n = 36
One opioid-involved ED-only visit n = 133
Zero opioid-involved ED-only visits n = 845
Did not die of a drug overdose in 2014 n = 2,398,958
Patients with a cause of death that is not drug overdose
Died of another cause in 2014 n = 32,003
ICD–9–CM diagnosis codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, or 970.1, or external cause-of-injury codes E850.0–E850.2
Greater than one opioid-involved ED-only visit n = 26
One opioid-involved ED-only visit n = 178
Zero opioid-involved ED-only visits n = 31,799
Presumed alive in 2014 n = 2,366,955
ICD–9–CM diagnosis codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, or 970.1, or external cause-of-injury codes E850.0–E850.2
Greater than one opioid-involved ED-only visit n = 2,007
One opioid-involved ED-only visit n = 12,185
Zero opioid-involved ED-only visits n = 2,352,763
Patient-level

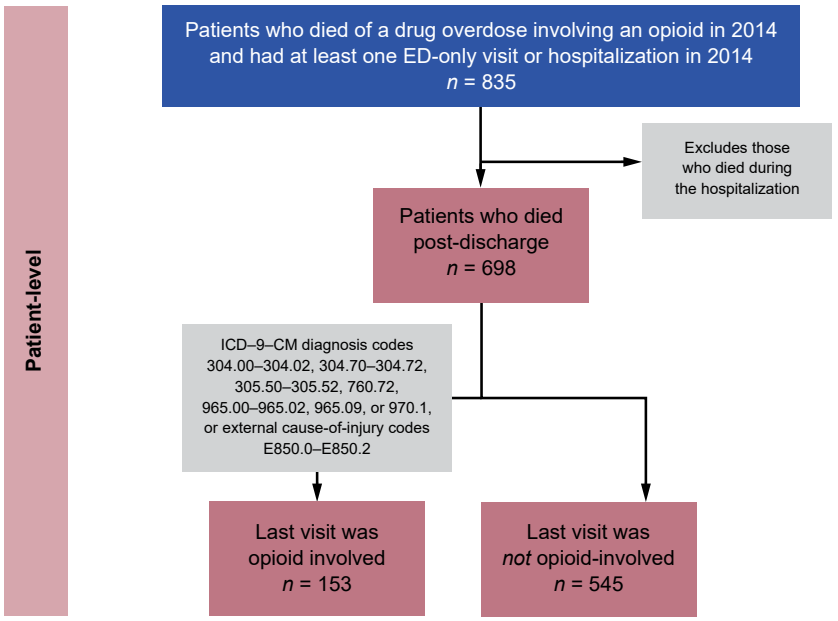
NOTES: ED is emergency department. NDI is National Death Index. ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*.
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Appendix IV. Figure. Study Population for Analyses of the 2014 National Hospital Care Survey Linked to the 2014–2015 National Death Index: Table D


2014 National Hospital Care Survey Patients (ED-only or hospitalization) n = 3,406,185
Excludes patients with solely ED-only visits, those ineligible to be linked to the NDI, and those who died during the hospitalization
Patients with hospitalizations and eligible to be linked to the NDI n = 987,111
Patients with an underlying cause-of-death code: X40–X44 (unintentional), X60–X64 (intentional self-harm or suicide), X85 (homicide), and Y10–Y14 (undetermined intent)
Died of a drug overdose in 2014 n = 568
Did not die of a drug overdose in 2014 n = 986,543
Patients with a cause of death that is not drug overdose
Died of another cause in 2014 n = 61,717
Presumed alive in 2014 n = 924,826
ICD–9–CM diagnosis codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, or 970.1, or external cause-of-injury codes E850.0–E850.2
Zero opioid-involved hospitalizations n = 395
One opioid-involved hospitalization n = 139
Greater than one opioid-involved hospitalization n = 34
Zero opioid-involved hospitalizations n = 60,844
One opioid-involved hospitalization n = 675
Greater than one opioid-involved hospitalization n = 198
Zero opioid-involved hospitalizations n = 905,170
One opioid-involved hospitalization n = 16,507
Greater than one opioid-involved hospitalization n = 3,149
Patient-level

NOTES: ED is emergency department. NDI is National Death Index. ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*.
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Appendix V. Figure. Study Population for Analyses of the 2014 National Hospital Care Survey Linked to the 2014–2015 National Death Index: Tables E and F


Patient-level
Patients who died of a drug overdose involving an opioid in 2014 and had at least one ED-only visit or hospitalization in 2014
n = 835
Excludes those who died during the hospitalization
Patients who died post-discharge
n = 698
ICD–9–CM diagnosis codes 304.00–304.02, 304.70–304.72, 305.50–305.52, 760.72, 965.00–965.02, 965.09, or 970.1, or external cause-of-injury codes E850.0–E850.2
Last visit was opioid involved
n = 153
Last visit was not opioid-involved
n = 545

NOTES: ED is emergency department. NDI is National Death Index. ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*.
SOURCES: NCHS, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

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